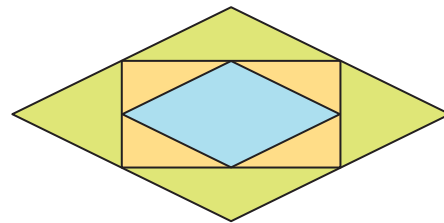


## 1.3 Finding Midpoints

**D**alton's class wants to design some interesting crop circles that are not circles. He starts with a diamond design.

To draw this diamond design, you start with the outer rhombus. You connect the midpoints of its sides to form a rectangle, and then connect the midpoints of the rectangle's sides.



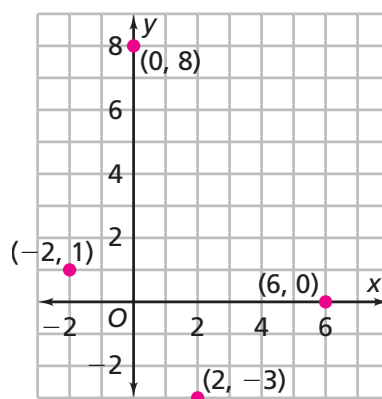
*What would you need to check to know that the yellow shape is a rectangle?*

*How could you create this pattern by measuring and drawing or by folding paper and tracing creases?*

### Getting Ready for Problem 1.3

To make symmetric designs on a coordinate grid, it is helpful to have strategies for finding the coordinates of midpoints of line segments.

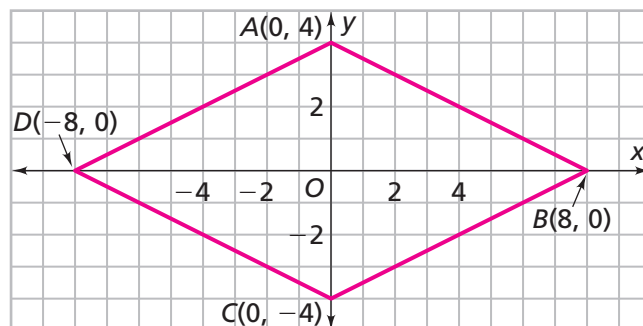
- How can you find the length of the line segment from  $(0, 8)$  to  $(6, 0)$  and from  $(-2, 1)$  to  $(2, -3)$ ?
- How can you estimate the coordinates of the midpoint of each segment?



### Problem 1.3 Finding Midpoints

**A.** The figure at the right is a rhombus.

1. Estimate coordinates of  $P$ , the midpoint of side  $AB$ . Estimate the coordinates of  $S$ , the midpoint of side  $AD$ .
2. Explain why  $\triangle APS$  is similar to  $\triangle ABD$ . What is the scale factor? How can you use these facts to check the coordinates of  $P$  and  $S$ ? How can you use these facts to confirm that  $P$  and  $S$  are the midpoints?



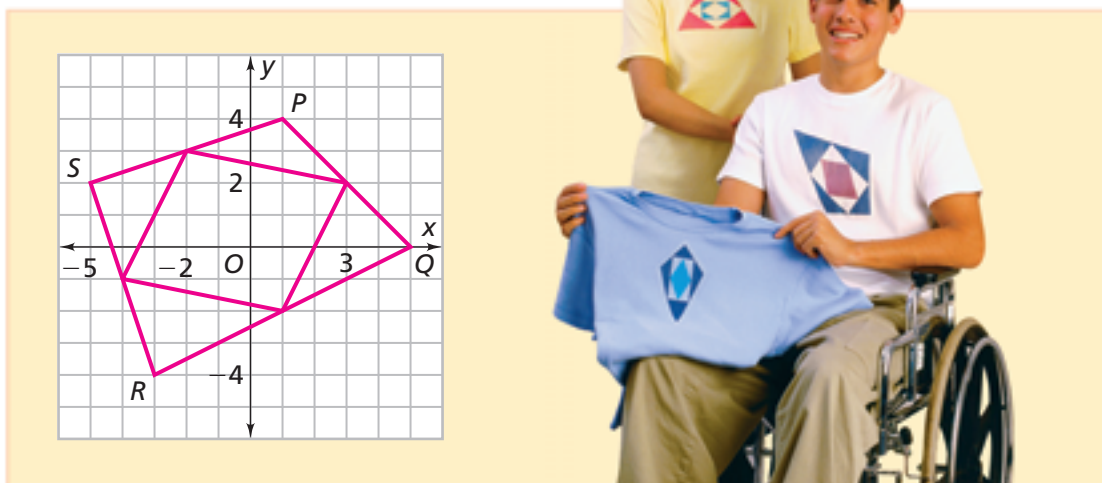
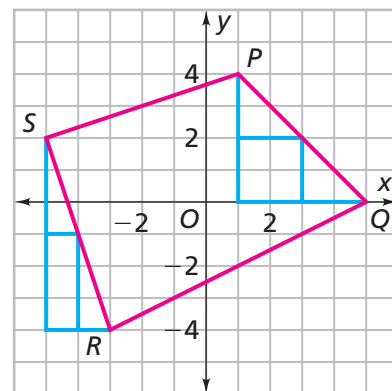
3. Find the midpoints of sides  $BC$  and  $CD$ .
4. Check the midpoint coordinates by calculating the distance from each midpoint to the endpoints of the segments on which it is located. (Hint: Use symmetry to limit the calculations you do.)

**B.** Dalton tries a quadrilateral that is not symmetric.

1. Dalton draws some lines on the quadrilateral to help him locate the midpoints of  $PQ$  and  $SR$ . Does this seem like a plan that would work no matter where  $P$  and  $Q$  or  $S$  and  $R$  are located? Explain.
2. Find coordinates of the midpoint of each side.
3. **a.** For each side, compare the coordinates of the endpoints to the coordinates of the midpoint. See if you can find a strategy for finding the coordinates of the midpoint of any line segment.
- b.** Use your findings to complete this statement:

*The midpoint of the segment with endpoints  $(a, b)$  and  $(c, d)$  has coordinates . . .*

**C.** Dalton connected the midpoints of the sides of  $PQRS$  to form a quadrilateral.



1. The quadrilateral appears to be a parallelogram. Verify this by finding the slopes of its sides.
2. Draw several quadrilaterals of your own. For each quadrilateral, find the midpoints of the sides (by measuring or paper folding), and connect those midpoints in order.
3. Describe the pattern in your results by completing this sentence:  
*When the midpoints of the sides of a quadrilateral are connected in order, the resulting figure is . . .*

**ACE** Homework starts on page 12.